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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**
(PCT Rule 43bis.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/DK2004/000452

International filing date (day/month/year)
25.06.2004

Priority date (day/month/year)
26.06.2003

International Patent Classification (IPC) or both national classification and IPC
G02B27/52, G02B27/09, G02B27/46

Applicant
RIS NATIONAL LABORATORY

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
☐ Box No. II Priority
☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐ Box No. IV Lack of unity of invention
☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐ Box No. VI Certain documents cited
☐ Box No. VII Certain defects in the international application
☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

10/562017
International application No.
PCT/DK2004/000452

IA/20 REG DCT/PTO 23 DEC 2005

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
☐ a sequence listing
☐ table(s) related to the sequence listing
 - b. format of material:
☐ in written format
☐ in computer readable form
 - c. time of filing/furnishing:
☐ contained in the international application as filed.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

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Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	2-4,8,11,15,17-22
	No: Claims	1,5,6,7,9,10,12,13,14,16
Inventive step (IS)	Yes: Claims	2-4,17-22
	No: Claims	8,11,15
Industrial applicability (IA)	Yes: Claims	1-22
	No: Claims	

2. Citations and explanations

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following documents :

D1 : US-A-20030030902

- 2.1 Claims 1 is not clear and in contradiction with the description (Article 6 PCT). The intensity pattern $I(x,y)$ in claim 1 is related to the parameters of the spatial phase filter (A , B_n , θ_n) and to the parameters of the phase modifying element ($\phi(x,y)$) by a mathematical relation. It appears that this mathematical relation expresses the intensity distribution as a sum over the intensity distributions obtained which each plane electromagnetic field. Such an expression is only valid if each plane electromagnetic field does not interfere with the other fields (which would be the case for mutually incoherent fields, orthogonally polarized fields, or fields of different wavelengths, etc). However, the description (on page 7, lines 2-4) states that the fields are "preferably non interfering", and therefore does not exclude the case of interfering fields, in contradiction with the mathematical expression in claim 1. Hence claim 1 is not clear and does not meet the requirements of Article 6 PCT.
- 2.2 The same argument applies, mutatis mutandis, to independent method claim 22.
- 2.3 For the following discussion with regard to novelty and inventive step, the assumption has been made that the said plane electromagnetic fields can be either interfering or non interfering.
- 3.1 With the assumption of paragraph 2.3, the present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 is not new in the sense of Article 33(2) PCT.
- 3.2 The document D1 discloses (figure 8 ; the references in parentheses applying to this document) a phase contrast system for synthesizing an intensity pattern, comprising

a source of electromagnetic fields (1) for emission of at least two

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substantially plane electromagnetic fields with different axes of propagation (each point of the spatial light modulating element emits a substantially plane electromagnetic field),

a phase modifying element (an object Ob) for phase modulation of the electromagnetic fields by phasor values and positioned so that the at least two electromagnetic fields are incident upon it at different respective angles of approach,

first Fourier optics (3) for Fourier transforming the phase modulated electromagnetic fields positioned in the propagation paths of the at least two phase modulated fields,

a spatial phase filter (44) with at least two phase shifting regions (441, 442 see figure 9B) positioned at respective zero-order diffraction regions of the at least two respective phase modulated electromagnetic fields for individually phase shifting the at least two respective Fourier transformed electromagnetic fields by predetermined respective phase shift values θ_n in relation to the remaining part of the at least two respective transformed electromagnetic fields, and

second Fourier optics (5) for forming the intensity pattern by Fourier transforming the at least two respective phase shifted Fourier transformed electromagnetic fields.

The phase modifying element (the object Ob) has fixed phasor values, but the phase shift values θ_n are not equal to $\pi/2$ nor π , the reasons being as follow :

The phase shift values of portions (442 see figure 9B) of the spatial phase filter (44) are set to π as a standard value (see paragraph [0239]). However the phase shift values are subsequently adjusted (by means of an image analysis device (8) and a parameter decision device (9)) in order to obtain the adequate image on the CCD camera 61 (see paragraphs [0244] to [0257]). The phase shift values are therefore not equal to $\pi/2$ nor π .

3.3 The subject-matter of claim 1 is therefore not new (Article 33(2) PCT).

4. Independent method claim 22 appears to be new and involving an inventive step

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(Article 33(2) and (3) PCT) the reason being that document D1 does not disclose a method comprising a step of calculating the phasor values of the phase modifying element (Ob).

5. Additional features of claims 5, 6, 7, 9, 10, 12, 13, 14 and 16 are disclosed in document D1 (figures 7 and 9). Hence dependent claims 5, 6, 7, 9, 10, 12, 13, 14 and 16 lack novelty (Article 33(2) PCT).
6. Dependent claims 8, 11 and 15 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect to inventive step, the reasons being that these feature relate to small constructional changes with respect to the device of document D1, that would be considered by a skilled person, according to circumstances, without involving an inventive step. Hence claims 8, 11 and 15 lack an inventive step (Article 33(3) PCT).
7. Dependent claims 2-4, 17-21 appear to be new and inventive (Article 33(2) and (3) PCT).

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